भारतीय मानक
Indian Standard

IS 15975 : 2020

गैस सिलिंडर — गैस सिलिंडरो की भराई की अवस्थाएँ

(पहला पुनरीक्षण)

Gas Cylinders — Conditions for Filling Gas Cylinders

(First Revision)

ICS 23.020.30

© BIS 2020

भारतीय मानक ब्यूरो
BUREAU OF INDIAN STANDARDS
मानक भवन, 9 बहादुरशाह ज़फर मार्ग, नई दिल्ली – 110002
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI-110002
www.bis.gov.in www.standardsbis.in

September 2020 **Price Group 7**

Gas Cylinders Sectional Committee, MED 16

FOREWORD

This Indian Standard (First Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Gas Cylinders Sectional Committee, had been approved by the Mechanical Engineering Divisional Council.

This standard was first published in 2013 after superseding IS 8866 : 1978 'Filling ratios and corresponding developed pressure for high pressure liquefiable gases contained in gas cylinder', IS 8867 : 1978 'Saturated vapour pressure and test pressure for low pressure liquefiable gases contained in gas cylinders' and IS 8868 : 1988 'Periodical inspection interval of gas cylinders in use'.

In this revision following major changes have been done:

a) Definition of gas mixture included.
b) Requirements of the gas mixture has been included.
c) Reference of Indian Standard has been made for identification of correct cylinder for the intended gas
d) Reference of Indian Standard for fusible plug for use with cylinder has been provided
e) Test period (years) has been revised for gases namely dimethylamine anhydrous, methyl chloride (Refrigerant gas r 40), methylamine. anhydrous, trimethylamine anhydrous, acetylene dissolved.

While formulating this standard considerable assistance has been taken from following International standards:

ISO 11622 : 2005	Gas cylinders — Conditions for filling gas cylinders
BS EN 13096 : 2004	Transportable gas cylinders — Conditions for filling gases into receptacles — Single component gases
BS EN 13099 : 2003	Transportable gas cylinders — Conditions for filling gas mixtures into receptacles

While implementing this standard, the manufacturer and the inspection agency shall ensure compliance with applicable statutory regulations.

In the case of high pressure liquefiable gases, the vapour pressure exerted by the gas in the cylinder increases with the increase in filling ratio, at the same temperature. This is in contrast to the low pressure liquefiable gases where this vapour pressure is constant for a particular gas for all filling ratios and equals the saturated vapour pressure at that temperature. For the high pressure liquefiable gases the 5 percent free space concept, applied in the case of low pressure liquefiable gases, has no application and it is quite practical to specify for each high pressure liquefiable gas, numerous filling ratio values each of which is associated with a given developed pressure at a particular temperature. The only thing that has to be ensured is that the cylinder has been designed taking into account the corresponding developed pressure associated with that particular filling ratio at the maximum attainable temperature of 65°C.

The composition of the Committee responsible for the formulation of this standard is given in Annex A.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

GAS CYLINDERS — CONDITIONS FOR FILLING GAS CYLINDERS

(First Revision)

1 SCOPE

This standard specifies the general requirements such as charging pressure, filling ratios, minimum cylinder test pressure, etc. for filling single gas cylinders and manifolded cylinder bundles with single component gases. This standard also covers the recommended interval for periodical inspection of gas cylinder in use containing different gases conveyed in cylinders.

This standard excluded the specific requirements for filling cryogenic gases and gas mixtures

2 REFERENCES

The following standards contain provisions which, through reference in this text, constitute provisions of this standard. At the time of publication the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below:

IS No.	*Title*
3224 : 2002	Valve fittings for compressed gas cylinders excluding liquefied petroleum gas (LPG) cylinders — Specification (*third revision*)
3933 : 1996	Colour identification of gas cylinders and related equipment intended for medical use
4379 : 1981	Identification of the contents of industrial gas cylinders (*first revision*)
5845 : 1993	Code of practice for inspection of low pressure welded steel gas cylinders other than LPG cylinders in use (*second revision*)
7241 : 1981	Glossary of terms used in gas cylinder technology (*first revision*)
8433 : 2017	Periodic inspection and maintenance of dissolved acetylene gas cylinders — Code of Practice (*second revision*)
8451 : 2018	Periodic inspection and testing of seamless steel gas cylinders — Code of practice (*third revision*)
13497 : 2017	Fusible plug for dissolved acetylene gas cylinder — Specification (*first revision*)

3 TERMINOLOGY

For the purpose of this standard, the definitions given in IS 7241 and the following shall apply shall apply.

3.1 Compressed Gas — Any permanent gas, liquefiable gas or gas dissolved in liquid under pressure or gas mixture which in a closed gas cylinder exercises a pressure either exceeding 2.5 kgf/cm^2 abs (1.5 kgf/cm^2 gauge) at 15^{o}C or a pressure exceeding 3 kgf/cm^2 abs (2 kgf/cm^2 gauge) at 50^{o}C or both;

NOTE — Hydrogen fluoride falls within the scope of compressed gas although its vapour pressure at 50^o C is 1.7 to 1.8 atmospheric gauge.

3.2 Settled Pressure or Filling Pressure — The maximum permissible gauge pressure, converted to 15^{o}C, at which a gas cylinder for permanent gas or gas dissolved under pressure can be filled. In other words, pressure of the contents of the cylinders at 15^{o}C.

3.3 Filling Ratio — The ratio of the weight of a liquefiable gas introduced in the cylinder to the weight of the water the cylinders will hold at 15^{o}C.

3.4 Developed Pressure —Pressure achieved by the contents of a gas cylinder filled according to this standard when raised to a specified reference temperature.

3.5 Maximum Development Pressure — The internal pressure developed by the gas at the maximum attainable temperature of 65^{o}C.

3.6 Test Pressure — Required pressure applied during a pressure test.

3.7 Tare Weight — In the case of liquefiable gases, it is the weight of empty cylinder with valve fitted. In the case of permanent gases, it is the weight of empty cylinder without the valve. In the case of dissolved acetylene, it is the weight of cylinder, having a valve and with or without safety devices, containing a porous mass, a solvent for the storage of dissolved acetylene, the quantity of acetylene required to saturate the solvent at atmospheric Pressure and at a temperature of 15°C and any valve protection permanently fixed directly to the cylinder.

3.8 Critical Temperature — Temperature above which a substance cannot exist in the liquid state.

3.9 High Pressure Liquefied Gas — Gas when packaged under pressure for transport is partially liquid at temperatures above -50°C and has a critical temperature between -10°C and 70°C

3.10 Low Pressure Liquefied Gas — Gas which when packaged under pressure for transport is partially liquid at temperatures above -50°C and has a critical temperature above 70°C.

3.11 Dissolved Gas — Gas when packaged under pressure for transport is dissolved in a liquid-phase solvent.

3.12 Gas Mixture — Mixture of two or more components, either liquid or gaseous, which have been deliberately filled for use from the cylinder as a blended mixture.

4 PRINCIPLES AND REQUIREMENTS FOR FILLING GAS CYLINDERS

4.1 General Requirements (All Gases and Gas Cylinders)

4.1.1 The gas to be used for filling shall be compatible with the cylinder, the cylinder valve and any other fittings that may be in contact with the gas.

4.1.2 The cylinders, when presented for filling, shall be within the specified period for periodic inspection and test in accordance with Table 1 to Table 6.

4.1.3 The cylinder shall be equipped with a suitable valve with the appropriate valve outlet as per IS 3224 or any other valve approved by Statutory Authority.

4.1.4 The cylinder and cylinder valve shall be in serviceable condition as per IS 5845, IS 8433 and IS 8451.

4.1.5 The cylinder shall be correctly identified for the intended gas as per IS 3933 or IS 4379 as applicable.

4.1.6 Filling ratios specified in this standard are maximum values. Hence, the filling mass charged into the cylinder shall take account of the accuracy of the filling procedure and weighing equipment.

4.1.7 The pressure relief device shall be suitably designed to a setting relative to the cylinder's test pressure. It shall operate between -10 percent and + 0 percent of the nominal release pressure of the PRD. However, it shall never exceed the cylinder test pressure.

4.2 Compressed Gases

The maximum settled pressure shall be the lower of the following values :

a) Two-thirds of the test pressure;

b) A pressure that does not exceed the cylinder test pressure when the cylinder content is raised to the reference temperature of 65°C;

c) The Pressure given in Table 1.

4.3 Low-pressure Liquefied Gases

4.3.1 The maximum internal pressure, which a low pressure liquefiable gas when contained in a cylinder can develop, is its saturated vapour pressure at the maximum attainable temperature, which is taken as 65°C in India. In the case of low pressure liquefiable gases, the saturated vapour pressure is independent of the filling ratio.

4.3.2 However, in the design of cylinders a safety factor of 1.5 is used. Therefore, the pressure to be used in the formulae for calculating the wall thickness of the gas cylinder (which is same as the hydrostatic test pressure) of cylinders containing low pressure liquefiable gas theoretically equals 1.5 times the saturated vapour pressure of the gas at 65°C. The recommended test pressure, P_h, given in this standard are not less than 1.5 times the saturated vapour pressure of the gas at 65°C, subject to a minimum of 18 bar. However, in the interest of industrial standardization, to account for the impurities present and to facilitate the change of cylinders from one gas service to another, the values of minimum recommended test pressures, P_h have been rationalized. In the interest of safety, particularly due to the poisonous nature of certain gases, still higher test pressure has been recommended in the case of such gases. In all cases, however, cylinders should be tested at the pressure marked on the cylinder.

4.3.3 At a filling ratio reference temperature of 50°C, there shall be a vapour space of at least 5 percent of the total cylinder water capacity, and the cylinder shall not be hydraulically full at any temperature up to 60°C.

4.3.4 Data for low-pressure liquefied gases are given in Table 2. The tare weight of the cylinder shall be as per statutory requirement. For pure gases where the filling data are not provided in Table 2, the following determination is required:

$$k_f = (0.003\,2 \times T_b - 0.24) \times \rho_l$$

where

k_f = maximum filling ratio;
T_b = boiling point (in Kelvin); and
ρ_l = density of liquid at boiling point (in kg/l).

4.4 High-Pressure Liquefied Gases

4.4.1 The chosen filling ratio shall be such that the developed pressure at a reference temperature of 65°C does not exceed the corresponding cylinder test pressure.

4.4.2 Data for high-pressure liquefied gases are given in Table 3. For high-pressure liquefied gases where filling data are not provided in Table 3, the maximum filling ratio shall be determined as follows:

$$k_f = 8.5 \times 10^{-4} \times \rho_g \times P_h$$

where

k_f = maximum filling ratio;
ρ_g = gas density in g/l (at 15°C and 1 bar); and
P_h = minimum test pressure (in bar).

If the density of the gas is unknown, the following formula can be used:

$$k_f = \frac{P_h \times M \times 10^{-3}}{R \times 338}$$

where

k_f = maximum filling ratio;
P_h = minimum test pressure (in bar);
M = molecular mass (in g/mol); and
R = 8.314 51 × 10^{-2} bar · l/mol · K (gas constant).

NOTE — For several gases from Table 3 (chlorotrifluoromethane, ethane, ethylene, hydrogen chloride, nitrous oxide, phosphine, silane, sulfur hexafluoride and trifluoromethane) the minimum test pressure can be below the value shown in Table 3, according to the filling ratio.

4.5 Dissolved Gases

If cylinders are filled with gases dissolved under pressure, the minimum test pressure shall be 60 bar in the case of acetylene for cylinders without pressure relief devices or 52 bar for cylinders with fusible plugs (*see* IS 13497). In the case of other dissolved gases, the test pressure shall correspond to that pressure resulting from a reference temperature of 65°C and prescribed concentration of the gas in the solvent (*see* Table 4).

4.6 All Gas Mixtures

4.6.1 The gas mixture to be filled shall be compatible with the cylinders, the cylinder valve and fittings that may be in contact with the gas.

4.6.2 The gas mixture components shall not react with each other, during or after mixing, in any manner which may affect the integrity of the cylinders or which may be dangerous.

4.6.3 The cylinders, when presented for filling, shall be within the specified period for periodic inspection and test.

5 SUBSTANCES AND PREPARATIONS DIRECTIVE CLASSIFICATION

a) O : Oxidizing;
b) F+ : Extremely flammable;
c) F: Highly flammable;
d) T+ : Very toxic;
e) T : Toxic;
f) Xn : Harmful;
g) C : Corrosive;
h) Xi : Irritant; and
j) N: Dangerous for the environment.

6 LIQUIDS FILLED IN THE CYLINDERS

Table 5 gives the liquids that can be filled into cylinders and its requirement.

7 GAS MIXTURES FILLED IN THE CYLINDERS

Table 6 gives the gas mixtures that can be filled into cylinders and its requirement.

Table 1 Compressed Gases

(*Clauses* 4.1.2 *and* 4.2)

Sl No	UN No.	Gas Name	Chemical Formula	Critical Temperature °c	Recommended Minimum Test Pressure (P_h) MPa(G)[1]	Settled Pressure P_{15} (At 15 °c)[1]	Substances and Preparations Directive Classification	Test Period (Years)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
i)	1002	Air, compressed			$(5/3)*P_{15}$	$(3/5)*P_h$		5
ii)	1006	Argon. compressed	Ar	-122.3	$(5/3)*P_{15}$	$(3/5)*P_h$	—	5
iii)	1016	Carbon monoxide. compressed	CO	-140.2	$(5/3)*P_{15}$	$(3/5)*P_h$	F+. T	2
iv)	1957	Deuterium. compressed	D_2	-234.8	$(5/3)*P_{15}$	$(3/5)*P_h$	(F+)	5
v)	1045	Fluorine. compressed	F_2	-129	19.61	2.8 MPa	T+. C	2
vi)	1046	Helium. compressed	He	-267.9	$(5/3)*P_{15}$	$(3/5)*P_h$	—	5
vii)	1049	Hydrogen. compressed	H_2	-239.9	$(5/3)*P_{15}$	$(3/5)*P_h$	F+	5
viii)	1056	Krypton. compressed	Kr	-63.8	$(5/3)*P_{15}$	$(3/5)*P_h$	—	5
ix)	1971	Methane. compressed/Compressed Natural gas	CH_4	-82.6	$(5/3)*P_{15}$	$(3/5)*P_h$	F+	3
x)	1065	Neon. compressed	Ne	-228.8	$(5/3)*P_{15}$	$(3/5)*P_h$	—	5
xi)	1660	Nitric oxide. compressed	NO	-92.9	19.61	5 MPa	(T+. O)	2
xii)	1066	Nitrogen. compressed	N_2	-147	$(5/3)*P_{15}$	$(3/5)*P_h$	—	5
xiii)	2190	Oxygen difluoride.compressed	OF_2	-58	19.61	2.8 MPa	(T+. O)	2
xiv)	1072	Oxygen. compressed	O_2	-118.4	$(5/3)*P_{15}$	$(3/5)*P_h$	O	5

[1] As per relevant IS/*Gas Cylinder Rules*, 2016.

Table 2 Low Pressure Liquefied Gases

(*Clauses* 4.1.2 *and* 4.3.3)

Sl No. (1)	Un No. (2)	Gas Name (3)	Chemical Formula (4)	Critical Temperature (5)	Recommended Cylinder Test Pressure In MPa(G) (6)	Filling Degree (Filling Ratio) (7)	Substances and Preparations Directive Classification (8)	Test Period (Years) (9)
i)	3159	1,1,1,2-Tetrafluoroethane (Refrigerant gas R 134a)	CF_3CH_2F	101.1	2.94	1.04 kg/l	-	5
ii)	2035	1,1,1-Trifluoroethane,(Refrigerant gas R 143a)	CF_3CH_3	73.1	4.90	0.75 kg/l	(F+)	5
iii)	1030	1,1-Difluoroethane,(Refrigerant gas R 152a)	CHF_2CH_3	113.5	2.45	0.79 kg/l	(F+)	5
iv)	1010	1,2-Butadiene, stabilized	$CH_2:C:CHCH_3$	176.1	1.77	0.59 kg/l	(F+)	5
v)	1958	1,2-Dichloro-1,1,2,2-tetra-fluoroethane (Refrigerantgas R 114)	$CClF_2CClF_2$	145.7	1.77	1.30 kg/l	-	5
vi)	1010	1,3-Butadiene	$CH_2:CH::CH:CH_2$	152.0	1.77	0.55 kg/l	(F+)	5
vii)	1012	1-Butylene	$CH_2::CHC_2H_5$	146.4	1.77	0.53 kg/l	F+	5
viii)	2517	1-Chloro-1,1-difluoroethane(Refrigerant gas R 142b)	$CClF_2CH_3$	137.1	1.77	0.99 kg/l	(F+)	5
ix)	1021	1-Chloro-1,2,2,2-tetrafluoroethane,(Refrigerant gas R 124)	$CHClFCF_3$	122.3	1.77	1.20 kg/l	-	5
x)	1983	1-Chloro-2,2,2-trifluoro-ethane (Refrigerant gas R133a)	CH_2ClCF_3	150	1.77	1.18 kg/l	-	5
xi)	2044	2,2-Dimethylpropane	$CH_3C(CH_3)_2CH_3$	160.6	1.77	0.53 kg/l	F+	5
xii)	1005	Ammonia. anhydrous	NH_3	132.4	4.41	0.53 kg/l	T. N	2
xiii)	2188	Arsine	AsH_3	99.9	9.81	1.10 kg/l	F+. T+. N	2
xiv)	1741	Boron trichloride	BCl_3	178.8	5.88	1.19 kg/l	T+	2
xv)	2901	Bromine chloride	BrCl	—	1.77	1.5 kg/l	(T. O)	2
xvi)	2419	Bromotrifluoroethylene	C_2BrF_3	184.8	1.77	1.19 kg/l	(F+)	5
xvii)	2204	Carbonyl sulphide	COS	102.0	3.43	0.84 kg/l	(F+. T)	2
xviii)	1017	Chlorine	Cl_2	144.0	2.94	1.25 kg/l	T. N	2
xix)	2548	Chlorine pentafluoride	ClF_5	142.6	1.77	1.49 kg/l	(T+. O)	2
xx)	1749	Chlorine trifluoride	ClF_3	153.7	4.41	1.40 kg/l	(T. O)	2
xxi)	1974	Chlorodifluorobromome-thane (Refrigerant gas R12B1)	$CBrClF_2$	153.7	1.77	1.61 kg/l	-	5
xxii)	1018	Chlorodifluoromethane. (Refrigerant gas R 22)	$CHClF_2$	96.2	4.41	1.03 kg/l	-	5

Table 2 (*Continued*)

Sl No. (1)	Un No. (2)	Gas Name (3)	Chemical Formula (4)	Critical Temperature (5)	Recommended Cylinder Test Pressure In MPa(G) (6)	Filling Degree (Filling Ratio) (7)	Substances and Preparations Directive Classification (8)	Test Period (Years) (9)
xxiii)	1020	Chloropentafluoroethane .(Refrigerant gas R 115)	C_2ClF_5	80	3.43	1.06 kg/l	-	5
xxiv)	1012	cis-2-Butylene	$CH_3CH::CHCH_3$	162.4	1.77	0.55 kg/l	F+	5
xxv)	1026	Cyanogen	$(CN)_2$	126.6	14.71	0.70 kg/l	F. T	2
xxvi)	1589	Cyanogen chloride. inhibited	ClCN	215	2.94	1.03 kg/l	(T+. C)	2
xxvii)	2601	Cyclobutane	C_4H_8	186.8	1.77	0.63 kg/l	(F+)	5
xxviii)								
xxix)	1027	Cyclopropane	C_3H_6	125.2	2.94	0.53 kg/l	F+	5
xxx)	1028	Dichlorodifluoromethane.(Refrigerant gas R 12)	CCl_2F_2	112	2.45	1.15 kg/l	-	5
xxxi)	1029	Dichlorofluoromethane.(Refrigerant gas R 21)	$CHCl_2F$	178.5	1.77	1.23 kg/l	-	5
xxxii)	2189	Dichlorosilane	SiH_2Cl_2	176.3	1.77	0.90 kg/l	(F+. T)	2
xxxiii)	3252	Difluoromethane (Refrigerant gas R 32)	CH_2F_2	78.1	6.86	0.78 kg/l	(F+)	5
xxxiv)	1033	Dimethyl ether	CH_3OCH_3	126.9	2.45	0.58 kg/l	F+	5
xxxv)	1032	Dimethylamine. anhydrous	$NH(CH_3)_2$	164.6	1.77	0.59 kg/l	F+. Xn	2
xxxvi)		Dimethylsilane	C2H8Si	125,0	1.77	0,51 kg/l	(F+)	5
xxxvii)	1067	Dinitrogen tetroxide.(Nitrogen dioxide)	N_2O_4	158	1.77	1.30 kg/l	T+	2
xxxviii)		Disilane	H6Si 2	150,9	1.77	0,74 kg/l	(F+)	5
xxxix)	2452	Ethyl acetylene. Stabilized	C_2H_5CCH	190.5	1.77	0.57 kg/l	(F+)	5
xl)	1037	Ethyl chloride (Refrigerant gas R 160)	C_2H_5Cl	187.2	1.77	0.80 kg/l	F+. Xn	5
xli)	2453	Ethyl fluoride (Refrigerantgas R 161)	C_2H_5F	102.2	4.41	0.57 kg/l	(F+)	5
xlii)	1039	Ethyl methyl ether	$C_2H_5OCH_3$	164.7	1.77	0.64 kg/l	F+	5
xliii)	1036	Ethylamine	$NH_2C_2H_5$	183.4	1.77	0.61 kg/l	F+. Xi	5
xliv)	1040	Ethylene oxide	C_2H_4O	195.8	1.77	0.78 kg/l	F+. T	2
xlv)	3296	Heptafluoropropane (Refrigerant gas R 227)	C_3HF_7	103	1.77	1.20 kg/l	-	5
xlvi)	2420	Hexafluoroacetone	C_3F_6O	84.1	2.94	1.08 kg/l	(T)	2
xlvii)	1858	Hexafluoropropylene.(Refrigerant gas R 1216)	$C_3{}^F{}_6$	86.2	2.94	1.11 kg/l	Xn	5

Table 2 (*Continued*)

Sl No. (1)	Un No. (2)	Gas Name (3)	Chemical Formula (4)	Critical Temperature (5)	Recommended Cylinder Test Pressure In MPa(G) (6)	Filling Degree (Filling Ratio) (7)	Substances and Preparations Directive Classification (8)	Test Period (Years) (9)
xlviii)	1048	Hydrogen bromide.anhydrous	HBr	89.9	7.35	1.54 kg/l	C	2
xlix)	2197	Hydrogen iodide.anhydrous	HI	150.8	2.94	2.25 kg/l	C	2
l)	2202	Hydrogen selenide.anhydrous	H_2Se	138	4.41	1.60 kg/l	(F+. T+)	2
li)	1053	Hydrogen sulphide	H_2S	100.1	7.35	0.67 kg/l	F+. T+. N	2
lii)	1969	Isobutane	$CH_3CH(CH_3)CH_3$	134.9	1.77	0.49 kg/l	F+	5
liii)	1055	Isobutylene	$CH_2{:}C(CH_3)_2$	144.7	1.77	0.52 kg/l	F+	5
liv)	1062	Methyl bromide	CH_3Br	194	1.77	1.51 kg/l	T. N	2
lv)	1063	Methyl chloride.(Refrigerant gas R 40)	CH_3Cl	143	2.45	0.81 kg/l	F+. Xn	2
lvi)	2534	Methyl chlorosilane	CH_5ClSi	200,0	1.77		(F+, T)	2
lvii)	1064	Methyl mercaptan	CH_3SH	196.8	1.77	0.78 kg/l	F+. Xn	5
lviii)	1061	Methylamine. anhydrous	NH_2CH_3	156.9	1.77	0.58 kg/l	F+. Xn	2
lix)	1011	*n*-Butane	C_4H_{10}	152	1.77	0.51 kg/l	F+	5
lx)	1069	Nitrosyl chloride	ClNO	167.5	4.90	1.10 kg/l	(T+. C)	2
lxi)	2422	Octafluorobut-2-ene(Refrigerant gas R 1318)	C_4F_8	98.3	1.77	1.34 kg/l	-	5
lxii)	1976	Octafluorocyclobutane(Refrigerant gas R C318)	C_4F_8	115.3	1.77	1.34 kg/l	-	5
lxiii)	2424	Octafluoropropane(Refrigerant gas R 218)	C_3F_8	71.9	3.43	1.09 kg/l	-	5
lxiv)	3083	Perchloryl fluoride	$ClFO_3$	95.2	5.88	1.21 kg/l	(T+. O)	2
lxv)	3154	Perfluoro(ethyl vinyl ether)	C_4F_8O	132.8	1.77	0.98 kg/l	(F+)	5
lxvi)	3153	Perfluoro(methyl vinyl ether)	C_3F_6O	87	2.94	0.75 kg/l	(F+)	5
lxvii)	1076	Phosgene	$COCl_2$	182.3	5.88	1.23 kg/l	T+	2
lxviii)	2200	Propadiene. stabilized	C_3H_4	120.7	2.94	0.50 kg/l	(F+)	5
lxix)	1978	Propane	C_3H_8	96.8	3.43	0.42 kg/l	F+	5
lxx)	1077	Propylene	C_3H_6	92.4	4.41	0.43 kg/l	F+	5
lxxi)	2194	Selenium hexafluoride	SeF_6		4.90	1.46 kg/l	T	2
lxxii)	2676	Stibine	SbH_3	173	9.81	1.20 kg/l	(F+. T+)	2

Table 2 (*Concluded*)

Sl No. (1)	Un No. (2)	Gas Name (3)	Chemical Formula (4)	Critical Temperature (5)	Recommended Cylinder Test Pressure In MPa(G) (6)	Filling Degree (Filling Ratio) (7)	Substances and Preparations Directive Classification (8)	Test Period (Years) (9)
lxxiii)	1079	Sulphur dioxide	SO_2	157.5	1.77	1.23 kg/l	T	2
lxxiv)	2418	Sulphur tetrafluoride	SF_4	91	5.88	0.91 kg/l	(T+. C)	2
lxxv)	2191	Sulphuryl fluoride	SO_2F_2	91.8	7.35	1.10 kg/l	T	2
lxxvi)	2195	Tellurium hexafluoride	TeF_6	83.2	9.81	1.00 kg/l	(T+)	2
lxxvii)	1012	trans-2-Butylene	$CH_3CH::CHCH_3$	155.5	1.77	0.54 kg/l	F+	5
lxxviii)	3057	Trifluoroacetyl chloride	C_2ClF_3O	109	5.88	1.17 kg/l	(T+)	2
lxxix)	1082	Trifluorochloroethylene.stabilized	C_2ClF_3	105.8	2.45	1.13 kg/l	(F+. T)	2
lxxx)	1083	Trimethylamine. anhydrous	$N(CH_3)_3$	160.2	1.77	0.56 kg/l	F+. Xn	2
lxxxi)	2196	Tungsten hexafluoride	WF_6	170	5.88	2.70 kg/l	(T+)	2
lxxxii)	1085	Vinyl bromide. stabilized	C_2H_3Br	198	1.77	1.37 kg/l	F+. T	2
lxxxiii)	1086	Vinyl chloride. stabilized	C_2H_3Cl	156.5	1.77	0.81 kg/l	F+. T	2
lxxxiv)	1087	Vinyl methyl ether. inhibited	$C_2H_3OCH_3$	171.6	1.77	0.67 kg/l	F+	5

Table 3 High Pressure Liquefied Gases

(*Clauses* 4.1.2 *and* 4.4.2)

Sl No.	UN No.	Gas name	Chemical Formula	Critical Temperature °C	Recommended Cylinder Test Pressure in MPa(g)	Filling Degree (Filling Ratio)	Substances and Preparations Directive Classification	Test Period (Years)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
i)	1959	1.1-Difluoroethylene.(Refrigerant gas R 1132a)	CF_2CH_2	29.7	24.52	0.77 kg/l	(F+)	5
ii)	1008	Boron trifluoride	BF_3	-12.2	22.07	0.715kg/l	T+. C	2
iii)	1008	Boron trifluoride	BF_3	-12.2	29.42	0.86 kg/l	T+. C	2
iv)	1009	Bromotrifluoromethane. (Refrigerant gas R 13B1)	$CBrF_3$	66.8	5.88	1.13 kg/l	-	5
v)	1009	Bromotrifluoromethane. (Refrigerant gas R 13B1)	$CBrF_3$	66.8	14.71	1.44 kg/l	-	5
vi)	1009	Bromotrifluoromethane. (Refrigerant gas R 13B1)	$CBrF_3$	66.8	24.52	1.60 kg/l	-	5
vii)	1013	Carbon dioxide	CO_2	30.1	18.63	0.667 kg/l	-	5
viii)	1013	Carbon dioxide	CO_2	30.1	24.52	0.75 kg/l	-	5
ix)	1013	Carbon dioxide	CO_2	30.1		0.60 kg/l	-	5
x)	2417	Carbonyl fluoride	CF_2O	14.7	19.61	0.47 kg/l	(T. C)	2
xi)	2417	Carbonyl fluoride	CF_2O	14.7	29.42	0.70 kg/l	(T. C)	2
xii)	1022	Chlorotrifluoromethane.(Refrigerant gas R 13)	$CClF_3$	28.8	14.71	0.83 kg/l	-	5
xiii)	1022	Chlorotrifluoromethane.(Refrigerant gas R 13)	$CClF_3$	28.8	11.77	0.90 kg/l	-	5
xiv)	1022	Chlorotrifluoromethane.(Refrigerant gas R 13)	$CClF_3$	28.8	18.63	1.04 kg/l	-	5
xv)	1022	Chlorotrifluoromethane.(Refrigerant gas R 13)	$CClF_3$	28.8	24.52	1.10 kg/l	-	5
xvi)	1911	Diborane	B_2H_6	16	24.52	0.07 kg/l	(F+. T+)	2
xvii)	1035	Ethane	C_2H_6	32.3	14.71	0.32 kg/l	F+	5
xviii)	1035	Ethane	C_2H_6	32.3	14.71	0.37 kg/l	F+	5
xix)	1035	Ethane	C_2H_6	32.3	29.42	0.39 kg/l	F+	5
xx)	1962	Ethylene	C_2H_4	9.2	22.07	0.34 kg/l	F+	5
xxi)	1962	Ethylene	C_2H_4	9.2	29.42	0.37 kg/l	F+	5
xxii)	2192	Germane [pyrophoric]	GeH_4	34.9	24.52	1.02 kg/l	(F+. T+)	2
xxiii)	2193	Hexafluoroethane.(Refrigerant gas. R 116)	C_2F_6	19.7	19.61	1.10 kg/l	-	5
xxiv)	1050	Hydrogen chloride. anhydrous	HCl	51.5	9.81	0.30 kg/l	T. C	2
xxv)	1050	Hydrogen chloride. anhydrous	HCl	51.5	11.77	0.56 kg/l	T. C	2
xxvi)	1050	Hydrogen chloride. anhydrous	HCl	51.5	14.71	0.67 kg/l	T. C	2
xxvii)	1050	Hydrogen chloride. anhydrous	HCl	51.5	19.61	0.74 kg/l	T. C	2
xxviii)	2454	Methyl fluoride (Refrigerantgas R 41)	CH_3F	44.6	29.42	0.36 kg/l	(F+)	5

Table 3 (*Concluded*)

Sl No. (1)	UN No. (2)	Gas name (3)	Chemical Formula (4)	Critical Temperature °C (5)	Recommended Cylinder Test Pressure in MPa(g) (6)	Filling Degree (Filling Ratio) (7)	Substances and Preparations Directive Classification (8)	Test Period (Years) (9)
xxix)	2454	Methyl fluoride (Refrigerantgas R 41)	CH_3F	44.6	29.42	0.36 kg/l	(F+)	5
xxx)	2451	Nitrogen trifluoride	NF_3	-39.3	19.61	0.50 kg/l	(O)	5
xxxi)	2451	Nitrogen trifluoride	NF_3	-39.3	29.42	0.75 kg/l	(O)	5
xxxii)	1070	Nitrous oxide	N_2O	36.4	17.65	0.667 kg/l	(O)	5
xxxiii)	1070	Nitrous oxide	N_2O	36.4	22.07	0.74 kg/l		5
xxxiv)	1070	Nitrous oxide	N_2O	36.4	15.20	0.625 kg/l		5
xxxv)	1070	Nitrous oxide	N_2O	36.4	24.52	0.75 kg/l		5
xxxvi)	3220	Pentafluoroethane(Refrigerant gas R 125)	C_2HF_5	66.2	4.90	0.72 kg/l	-	5
xxxvii)	3220	Pentafluoroethane(Refrigerant gas R 125)	C_2HF_5	66.2	6.37	0.95 kg/l	-	5
xxxviii)	2199	Phosphine [pyrophoric]	PH_3	51.9	22.07	0.30 kg/l	(F+. T+)	2
xxxix)	2199	Phosphine [pyrophoric]	PH_3	51.9	24.52	0.51 kg/l	(F+. T+)	2
xl)	2198	Phosphorus pentafluoride	PF_5	19	19.61	0.90 kg/l	(T+)	2
xli)	2198	Phosphorus pentafluoride	PF_5	19	29.42	1.34 kg/l	(T+)	2
xlii)	2203	Silane [pyrophoric]	SiH_4	-3.5	22.07	0.32 kg/l	(F+)	5
xliii)	2203	Silane [pyrophoric]	SiH_4	-3.5	24.52	0.41 kg/l	(F+)	5
xliv)	1859	Silicon tetrafluoride	SiF_4	-14.2	19.61	0.74 kg/l	(T. C)	2
xlv)	1859	Silicon tetrafluoride	SiF_4	-14.2	29.42	1.10 kg/l	(T. C)	2
xlvi)	1080	Sulphur hexafluoride	SF_6	45.6	9.81	1.04 kg/l	-	5
xlvii)	1080	Sulphur hexafluoride	SF_6	45.6	13.73	1.33 kg/l	-	5
xlviii)	1080	Sulphur hexafluoride	SF_6	45.6	15.69	1.37 kg/l	-	5
xlix)	1081	Tetrafluoroethylene.stabilized	C_2F_4	33.3	19.61	5 bar	(F+)	5
L)	1982	Tetrafluoromethane (Refrigerant gas. R 14)	CF_4	-45.7	19.61	0.62 kg/l	-	5
Li)	1982	Tetrafluoromethane (Refrigerant gas. R 14)	CF_4	-45.7	29.42	0.94 kg/l	-	5
Lii)	1984	Trifluoromethane.(Refrigerant gas R 23)	CHF_3	26	18.63	0.87 kg/l	-	5
Liii)	1984	Trifluoromethane.(Refrigerant gas R 23)	CHF_3	26	24.52	0.95 kg/l	-	5
Liv)	1860	Vinyl fluoride. inhibited	C_2H_3F	54.7	24.52	0.64 kg/l	(F+)	5
Lv)	2036	Xenon	Xe	16.6	12.75	1.24 kg/l	-	5

Table 4 Dissolved Gases

(*Clauses* 4.1.2 *and* 4.5)

Sl No.	UN No.	Gas Name	Chemical Formula	Critical Temperature	Minimum Test Pressure (P_h)	Settled Pressure P_{15} or Filling Degree	Substances and Preparations Directive Classification	Test Period (Years)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
i)	1001	Acetylene. dissolved	C_2H_2	35.2	5.2 or 6 MPa		F+	2
ii)	2073	Ammonia solution, relative density less than 0,88 at15 Â°C in water, with >40 percent but <- 50 percent ammonia	NH_3 in H_2O	132.4	1.8 MPa	0.77 kg/l	C. N	2

Table 5 Liquid Filled in Cylinders

(*Clauses* 4.1.2 *and* 6)

Sl No.	UN No.	Name of the Liquid	Chemical Formula	Boiling Point	Minimum Test Pressure MPa	Filling Degree	Substances and Preparations	Test Period (years)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
i)	1745	Bromine pentafluoride	BrF_5	40.5	0.98	92 percent	(T+, O)	2
ii)	1746	Bromine trifluoride	BrF_3	125.8	0.98	92 percent	(T+, O)	2
iii)	1366	Diethylzinc pyrophoric	$(C_2H_5)_2Zn$	117.6	0.98	90 percent	(F+, T+)	2
iv	1183	Ethyldichlorosilane	$SiH(C_2H_5)Cl_2$	73.89	0.39	0.93 kg/l	(F, T)	2
v)	1790	Hydrofluoric acid, solution	HF in H_2O	108	0.98	0.84 kg/l	T+, C	2
vi)	1051	Hydrogen cyanide	HCN	25.7	9.81	0.55 kg/l	F+, T+	2
vii)	1052	Hydrogen fluoride, anhydrous	HF	- 19.5	0.98	0.84 kg/l	T+, C	2
viii)	2495	Iodine pentafluoride	IF_5	104.5	0.98	92%	(T+, O)	2
ix)	1994	Iron pentacarbonyl	$Fe(CO)_5$	103.0	0.98	1.0 kg/l	(F, T)	2
x)	1242	Methyldichlorosilane	$SiH(CH_3)Cl_2$	41.0	0.39	0.95 kg/l	(F, T)	2
xi)	1259	Nickel carbonyl	$Ni(CO)_4$	43.0	0.98	1.0 kg/l	(F, T+)	2
xii)	1380	Pentaborane [pyrophoric]	B_5H_9	60.0	0.98	90%	(F+, T)	2
xiii)	1295	Trichlorosilane	$SiHCl_3$	32.0	0.39	1.14 kg/l	(F, T)	2
xiv)	3051	Aluminium alkylhalogenide	$Al(C_2H_5)_3$	186.6	0.98	90 percent	(F, T+)	2
xv)	2978	Uranium hexafluoride	UF_6	56.2	2.75	95 percent	(T+, C)	2

Table 6 Gas Mixtures

(*Clauses* 4.1.2 *and* 7)

Sl No. (1)	UN No. (2)	Gas Name (3)	Chemical Formula (4)	Boiling Point (5)	Minimum Test Pressure MPa (6)	Filling Degree (7)	Substances and Preparations (8)	Test Period (years) (9)
i)	3163	R 410 A (difluoromethane, pentafluroethane)	—	71	6.37	0.81 kg/l	—	5
ii)	3337	R 404 A (pentafluoroethane,1,1,1- trifluoroethane, and 1,1,1,2- tetrafluoroetane zeotropic mixture with approximately 44 percent % pentafluoroethane and 52 percent 1,1,1-trifluoroethane)	—	72	2.94	0.82 kg/l	—	5
iii)	3340	R 407 C (difluoromethane, pentafluoroethane, and 1,1,1,2- tetrafluoroethane zeotropic mixture with approximately 23 percent% difluoromethane and 25 percent pentafluoroethane)	—	86	2.94	0.95 kg/l	—	5

ANNEX A

(*Foreword*)

COMMITTEE COMPOSITION

Gas Cylinder Sectional Committee, MED 16

Organization	*Representative(s)*
Petroleum And Explosive Safety Organization, Nagpur	Shri M. K. Jhala (***Chairman***) Shri V. K. Mishra (*Alternate* I) Shri Jamunalal Rout (*Alternate* II)
All India Industrial Gases Manufacturers Association, New Delhi	Shri Saket Tiku Shri K. R. Sahasranam (*Alternate*)
Ashok Leyland Limited, Chennai	Shri Ved Prakash Gautam Shri Faustino V. (*Alternate*)
Bharat Petroleum Corporation Ltd, Mumbai	Shri Maneesh Patney Shri Sudipta Sarkar (*Alternate*)
Bhiwadi Cylinders Pvt Ltd, New Delhi	Shri Manvinder Singh Shri Rajneesh Chopra (*Alternate* I) Shri Sunil K. Dey (*Alternate* II)
LINDE India Ltd, Kolkata	Shri Ramana Vutukuru Shri Pardeep (*Alternate*)
Everest Kanto Cylinder Ltd, Mumbai	Shri Ghanshyam Goyal Shri A. K. Khamkar (*Alternate* I) Shri A. S. V. S. Prasad (*Alternate* II)
Gujarat Gas Ltd (Formerly GSPC Gas Co Ltd), Surat	Shri Ravi Ravipalli
Hindustan Petroleum Corporation Ltd, Kolkata/ Mumbai	Shri Debashish Chakraverty Shri Pravin Manohar Hadke (*Alternate*)
Indian Oil Corporation Ltd, Mumbai	Shri Shankar Sharan Shri Sanjay Gupta (*Alternate*)
Indraprastha Gas Limited, Delhi	Shri Ujwal Bhandari Shri Sushil Kumar (*Alternate*)
International Industrial Gases Ltd, Howrah	Shri Devendra K. Garg Shri Nikhilesh K. Garg (*Alternate*)
INOX India Limited, Vadodara	Shri Deepak V. Patwardhan Shri Deepak V. Acharya (*Alternate*)
Kabsons Gas Equipments Ltd, Hyderabad	Shri Satish Kabra Shri S. Gopalaiah (*Alternate*)
Kosan Industries Ltd,Mumbai/Surat	Shri Girishbhai K. Desai Shri S. B. Bolmal (*Alternate*)
LPG Equipment Research Centre, Bengaluru	Shri K . K. Thakur Shri A. K. Bera (*Alternate*)
Mahanagar Gas Limited, Mumbai	Shri S. Murali Shri Milind M. Ranade (*Alternate*)
Ministry of Defence (DGQA), Pune	Joint Controller (Jag/Nfsg) Shri M. Satyanarayana Psco Shri S. B. Alhat Acqa (EP) (*Alternate* I) Shri Shri Ram (*Alternate* II)
Research and Development Estt (Engineers), Pune	Dr Shankar Bhaumik Shri Tamhankar Ravindra (*Alternate*)

Organization	*Representative(s)*
Society of Indian Automobile Manufacturers, New Delhi	Shri K. K. Gandhi Shri Amit Kumar (*Alternate*)
RDCIS, Steel Authority of India Ltd, Ranchi	Shri S. K. Mohapatra Shri Santosh Kumar (*Alternate*)
Supreme Cylinders Ltd, Delhi	Shri M. L. Fathepuria
Tata Motors Ltd, Pune	Shri Pallipalayam Gowrishankar Shri Shailendra Dewangan (*Alternate*)
Tekno Valves, Kolkata	Shri Y. K. Behani Shri Rohit Behani (*Alternate*)
The Automotive Research Association of India, Pune	Dr S. S. Thipse Shri S. D. Rairikar (*Alternate*)
Trans Valves (India) Pvt Ltd Hyderabad	Shri A. K. Jain Shri P. K. Mathur (*Alternate*)
Vanaz Engineers Pvt Ltd, Pune	Shri S. J. Vispute Shri A. S. LATKE (*Alternate*)
BIS, New Delhi	Shri Rajneesh Khosla, Scientist 'E' and Head (MED)

Member Secretary
Shri Chandan Gupta
Scientist 'C' (MED), BIS

Dissolved Acetylene Cylinders, Generators, Acetylene Pipe Lines And High Pressure Gas Cylinders Subcommittee, MED 16:3

Organization	*Representative(s)*
LINDE India Ltd, Kolkata	Shri Vutukuru Ramana (***Convener***)
Adani Gas Ltd, Ahmedabad	Shri Peeyush Tripathi Shri Amit Malik (*Alternate*)
Al-Can Exports Pvt Ltd, Distt Thane	Shri Vijay K. Parikh Shri D. C. Dave (*Alternate*)
All India Industrial Gases Manufacturers Association, New Delhi	Shri Saket Tiku Shri K. R. Sahasranam (*Alternate*)
Ashok Leyland Ltd, Chennai	Shri Ved Prakash Gautam Shri Faustino V. (*Alternate*)
Bharat Petroleum Corporation Ltd, Mumbai	Shri Maneesh Patney Shri Sudipta Sarkar (*Alternate*)
Everest Kanto Cylinder Ltd, Mumbai	Shri Ghanshyam Goyal Shri A. G. Khamkar(*Alternate* I) Shri A. S. V. S. Prasad (*Alternate* II)
Esteem Gases Pvt Ltd, Mumbai	Shri Saket Tiku Shri Uday Kamath (*Alternate*)
Hindalco Industries Limited, Mumbai	Dr Vivek Srivastava Shri Sudhir Jain (*Alternate*)

Organization	*Representative(s)*
Hindustan Petroleum Corporation Ltd, Kolkata/ Mumbai	Shri Debashish Chakraverty Shri Pravin Manohar Hadke (*Alternate*)
Indian Oil Corporation Ltd, Mumbai	Shri Shankar Sharan Shri Sanjay Gupta (*Alternate*)
Indraprastha Gas Limited, New Delhi	Shri Ujwal Bhandari Shri Sushil Kumar (*Alternate*)
International Industrial Gases Ltd, Howrah	Shri D. K. Garg Shri N. K. Garg (*Alternate*)
IOC R & D, Faridabad	Shri Umish Srivastava
Jai Maruti Gas Cylinders Pvt Ltd, Gwalior	Shri Ashok K. Nigam Shri Manu K. Nigam (*Alternate*)
KVK Corporation, Mumbai	Shri R. Chandgothia Shri V. Chandgothia (*Alternate*)
Luxfer Uttam India Pvt Ltd, Faridabad	Shri Karan Bhatia Shri Sandeep Bhasin (*Alternate*)
Ministry of Defence (DGQA) Pune	Lt Col A. Vasudeva Shri N. Saravanan (*Alternate*)
Natural Gas Society, Noida	Shri Vipin Chandra Chittoda Shri Vivek Joshi (*Alternate*)
Petroleum and Explosive Safety Organization, Nagpur	Shri M . K. Jhala Shri V. K. Mishra (*Alternate* I) Shri Jamunalal Rout (*Alternate* II)
Protego India Pvt Ltd, Mumbai	Shri Prasad Jawaji Shri Bal Bhandavle (*Alternate*)
Rama Cylinders Pvt Ltd, Mumbai	Shri Milind W Khadke Shri C. L. Kshirsagar (*Alternate* I) Shri Pramod W. Sangwai (*Alternate* II)
Sahuwala High Pressure Cylinder (P) Ltd, Visakhapatnam	Shri P. K. Gupta Shri Srinivas Rao (*Alternate*)
Society of Indian Automobile Manufacturers, New Delhi	Shri K. K. Gandhi Shri Amit Kumar (*Alternate*)
Tata Motors Ltd, Pune	Shri Pallipalayam Gowrishankar Shri Shailendra Dewangan (*Alternate*)
Tekno Valves, Kolkata	Shri Y. K. Behani Shri R. Behani (*Alternate*)
The Automotive Research Association of India, Pune	Shri S. S. Thipse Shri S. D. Rairikar (*Alternate*)

Bureau of Indian Standards

BIS is a statutory institution established under the *Bureau of Indian Standards Act*, 2016 to promote harmonious development of the activities of standardization, marking and quality certification of goods and attending to connected matters in the country.

Copyright

BIS has the copyright of all its publications. No part of these publications may be reproduced in any form without the prior permission in writing of BIS. This does not preclude the free use, in the course of implementing the standard, of necessary details, such as symbols and sizes, type or grade designations. Enquiries relating to copyright be addressed to the Director (Publications), BIS.

Review of Indian Standards

Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the latest issue of 'BIS Catalogue' and 'Standards: Monthly Additions'.

This Indian Standard has been developed from Doc No.: MED 16 (13663).

Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

BUREAU OF INDIAN STANDARDS

Headquarters:

Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110002
Telephones: 2323 0131, 2323 3375, 2323 9402 *Website*: www.bis.gov.in

Regional Offices: *Telephones*

Central : Manak Bhavan, 9 Bahadur Shah Zafar Marg
NEW DELHI 110002 — 2323 7617, 2323 3841

Eastern : 1/14 C.I.T. Scheme VII M, V.I.P. Road, Kankurgachi
KOLKATA 700054 — 2337 8499, 2337 8561, 2337 8626, 2337 9120

Northern : Plot No. 4-A, Sector 27-B, Madhya Marg
CHANDIGARH 160019 — 265 0206, 265 0290

Southern : C.I.T. Campus, IV Cross Road, CHENNAI 600113 — 2254 1216, 2254 1442, 2254 2519, 2254 2315

Western : Manakalaya, E9 MIDC, Marol, Andheri (East)
MUMBAI 400093 — 2832 9295, 2832 7858, 2832 7891, 2832 7892

Branches : AHMEDABAD. BENGALURU. BHOPAL. BHUBANESHWAR. COIMBATORE. DEHRADUN. DURGAPUR. FARIDABAD. GHAZIABAD. GUWAHATI. HYDERABAD. JAIPUR. JAMMU. JAMSHEDPUR. KOCHI. LUCKNOW. NAGPUR. PARWANOO. PATNA. PUNE. RAIPUR. RAJKOT. VISAKHAPATNAM.

Published by BIS, New Delhi